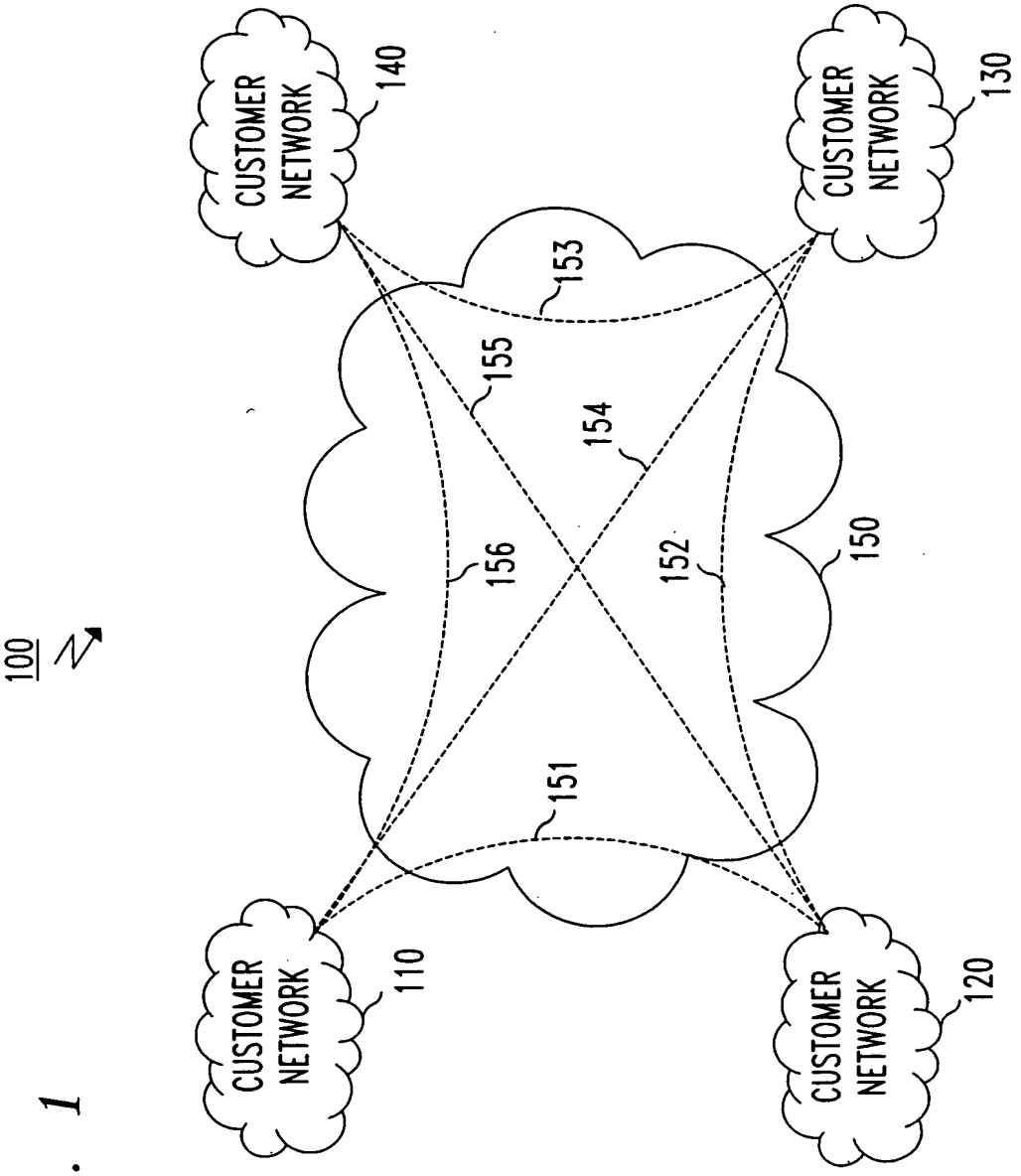

100
CUSTOMER NETWORK
110
CUSTOMER NETWORK
120
CUSTOMER NETWORK
130
CUSTOMER NETWORK
140
150
151
152
153
154
155
156

FIG. 1

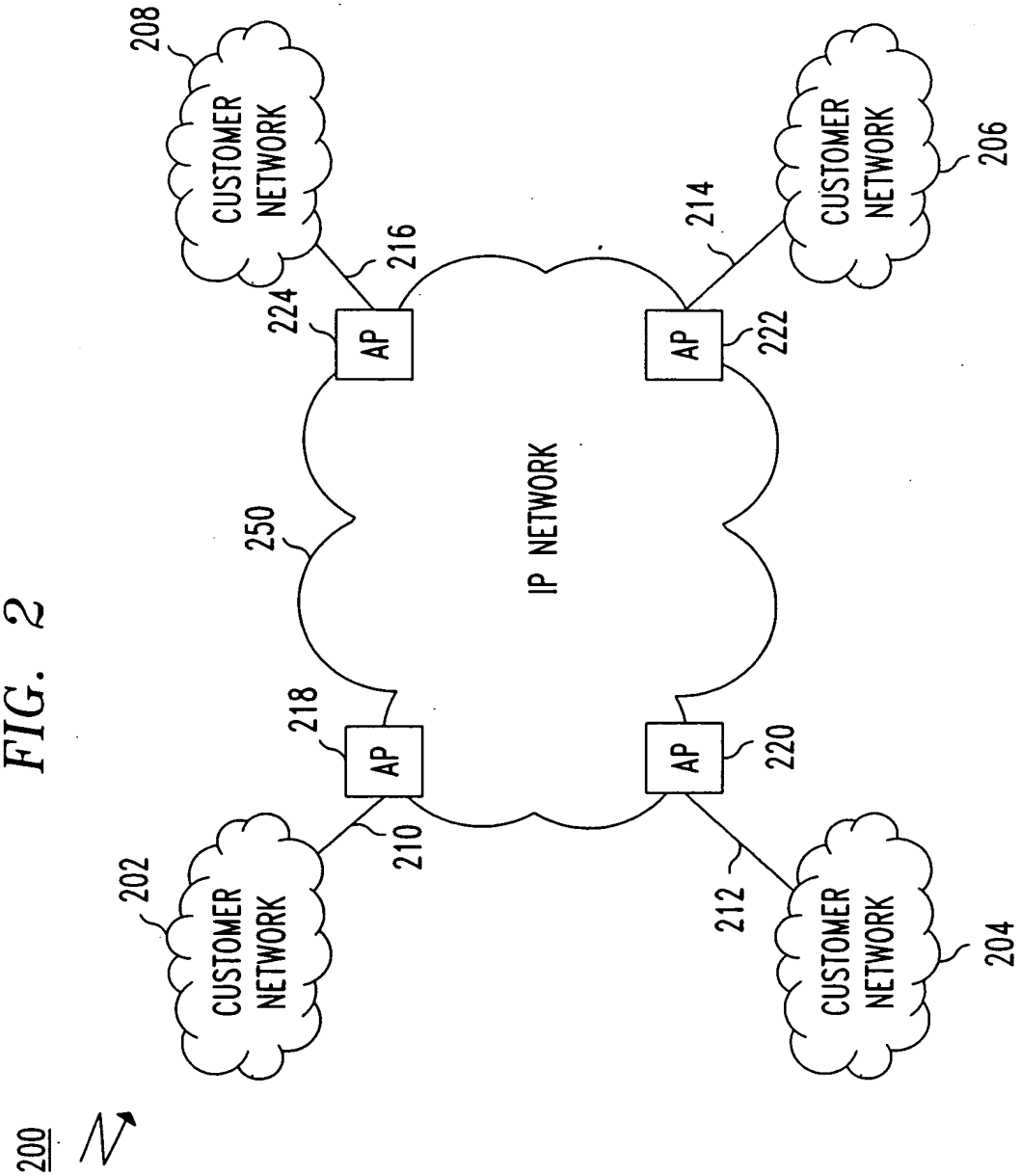

208
CUSTOMER NETWORK
206
CUSTOMER NETWORK
214
216
224
AP
AP
222
IP NETWORK
250
218
AP
AP
220
210
202
CUSTOMER NETWORK
212
CUSTOMER NETWORK
204
200

FIG. 2

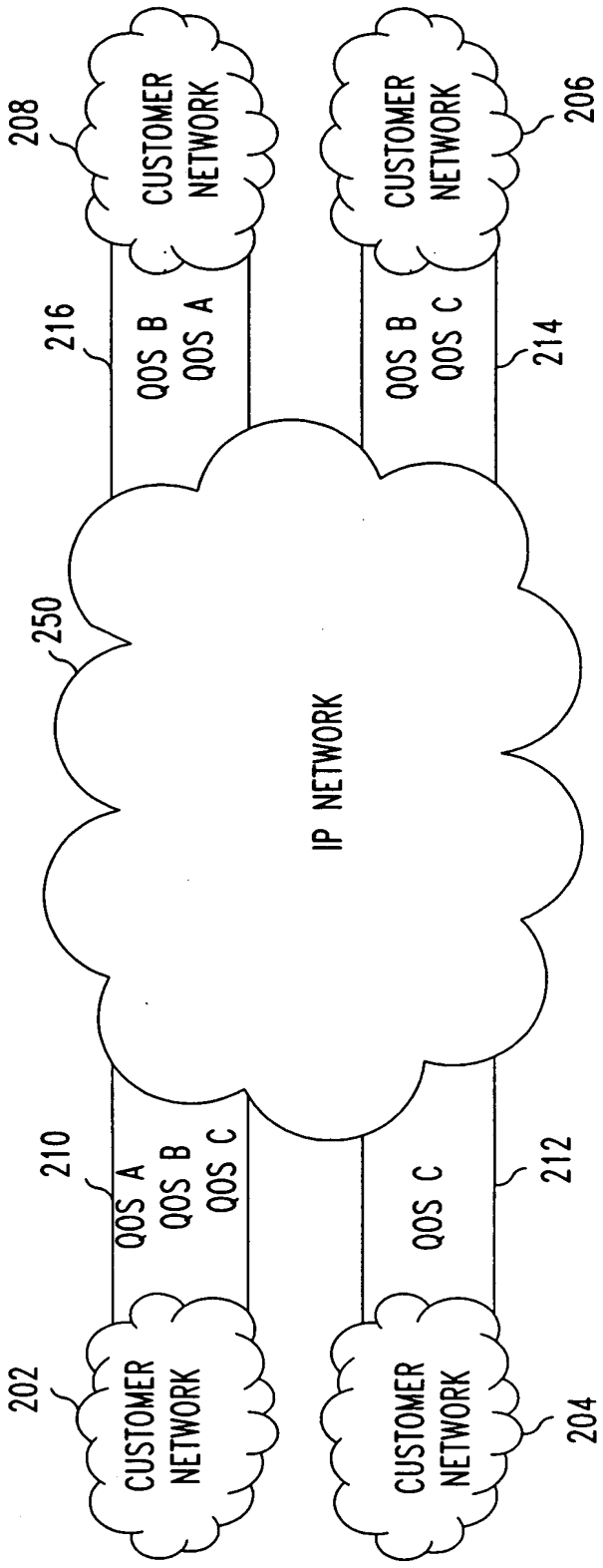
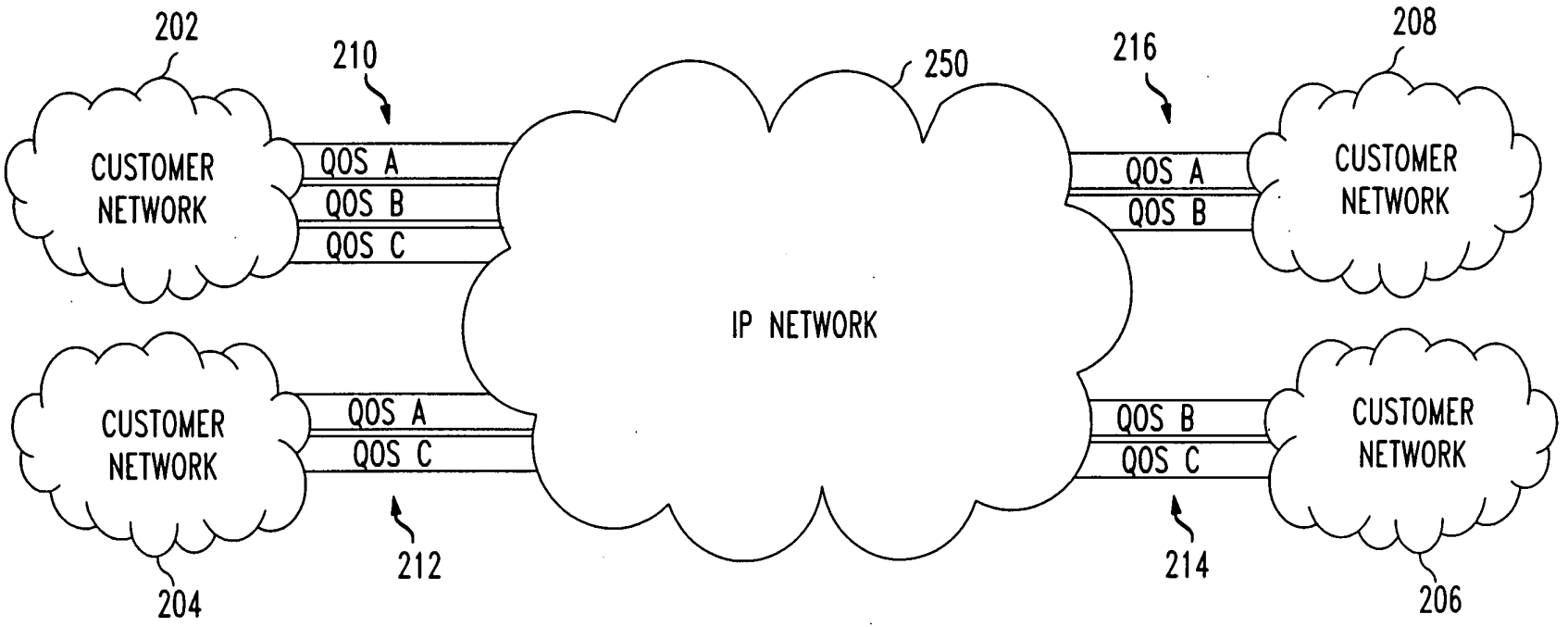

CUSTOMER NETWORK
208
CUSTOMER NETWORK
206
216
QOS B
QOS A
214
QOS B
QOS C
250
IP NETWORK
210
QOS A
QOS B
QOS C
212
QOS C
CUSTOMER NETWORK
202
CUSTOMER NETWORK
204

FIG. 3

FIG. 4



N.C. DUFFIELD ids 113605

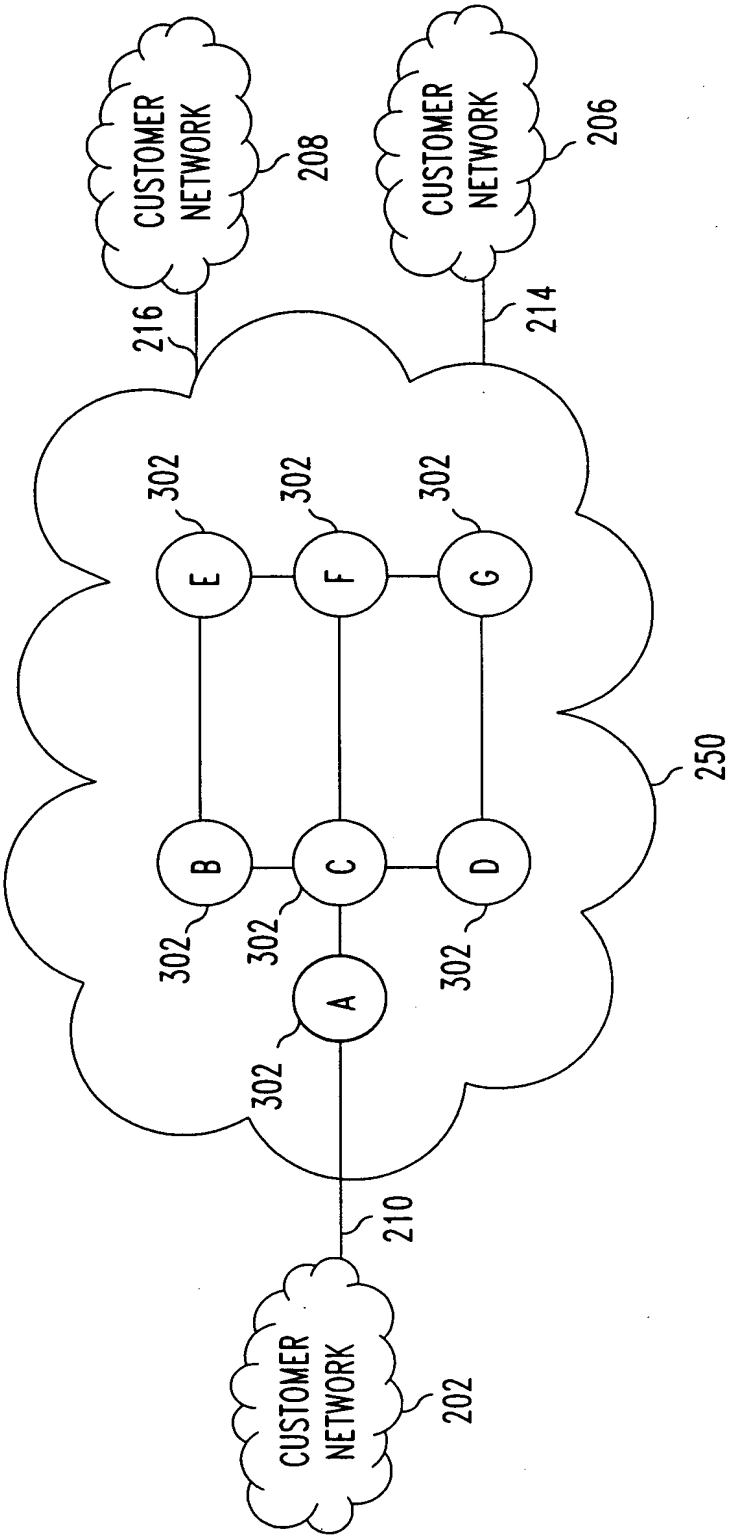

CUSTOMER NETWORK
208
CUSTOMER NETWORK
206
216
214
302
E
302
F
302
G
B
C
D
302
302
302
A
302
250
210
CUSTOMER NETWORK
202

FIG. 5

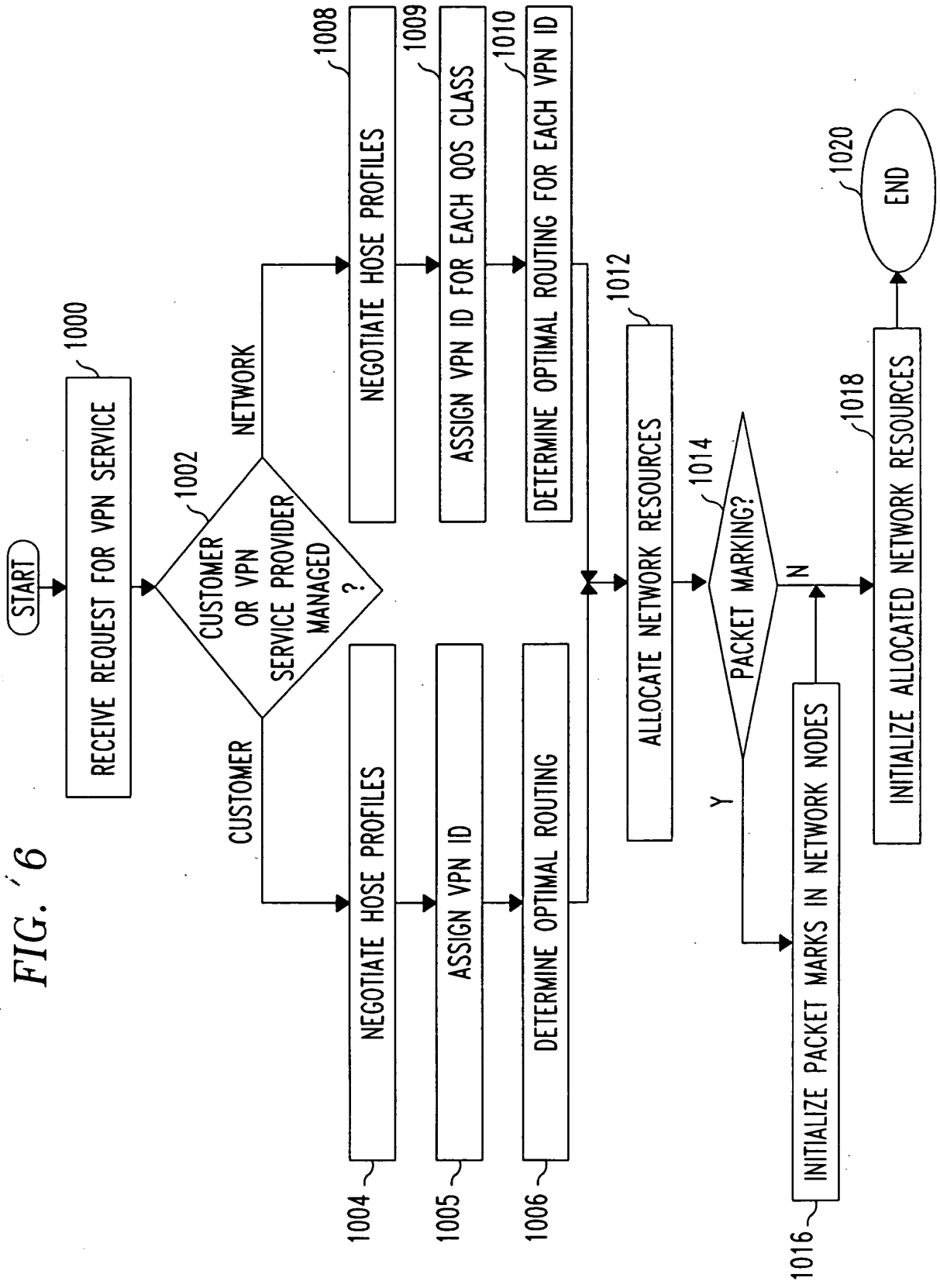

START
RECEIVE REQUEST FOR VPN SERVICE
1000
CUSTOMER OR VPN SERVICE PROVIDER MANAGED ?
1002
CUSTOMER
NETWORK
NEGOTIATE HOSE PROFILES
1004
ASSIGN VPN ID
1005
DETERMINE OPTIMAL ROUTING
1006
NEGOTIATE HOSE PROFILES
1008
ASSIGN VPN ID FOR EACH QOS CLASS
1009
DETERMINE OPTIMAL ROUTING FOR EACH VPN ID
1010
ALLOCATE NETWORK RESOURCES
1012
PACKET MARKING?
1014
Y
N
INITIALIZE PACKET MARKS IN NETWORK NODES
1016
INITIALIZE ALLOCATED NETWORK RESOURCES
1018
END
1020

FIG. 6

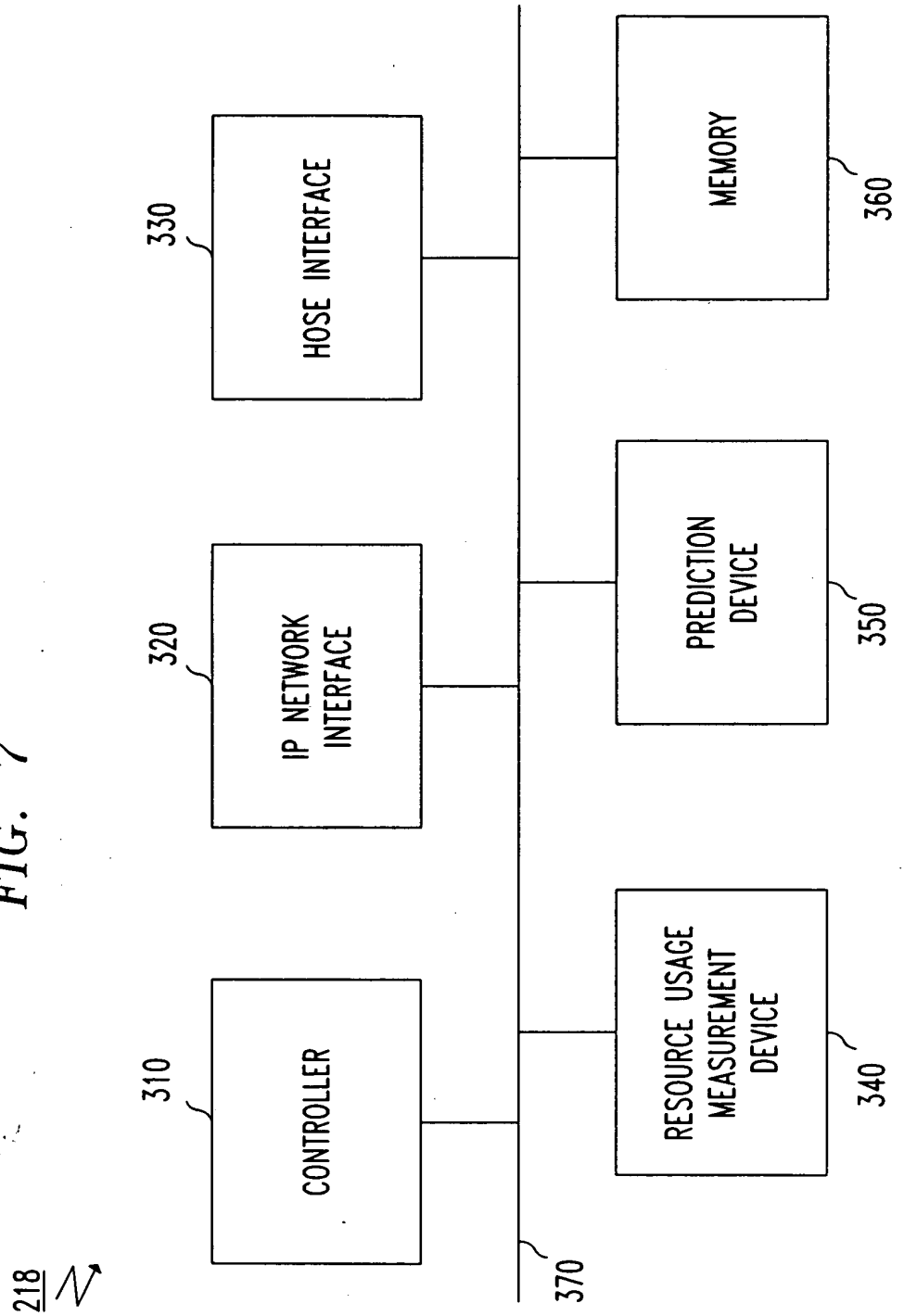

218
CONTROLLER
310
IP NETWORK INTERFACE
320
HOSE INTERFACE
330
RESOURCE USAGE MEASUREMENT DEVICE
340
PREDICTION DEVICE
350
MEMORY
360
370

FIG. 7

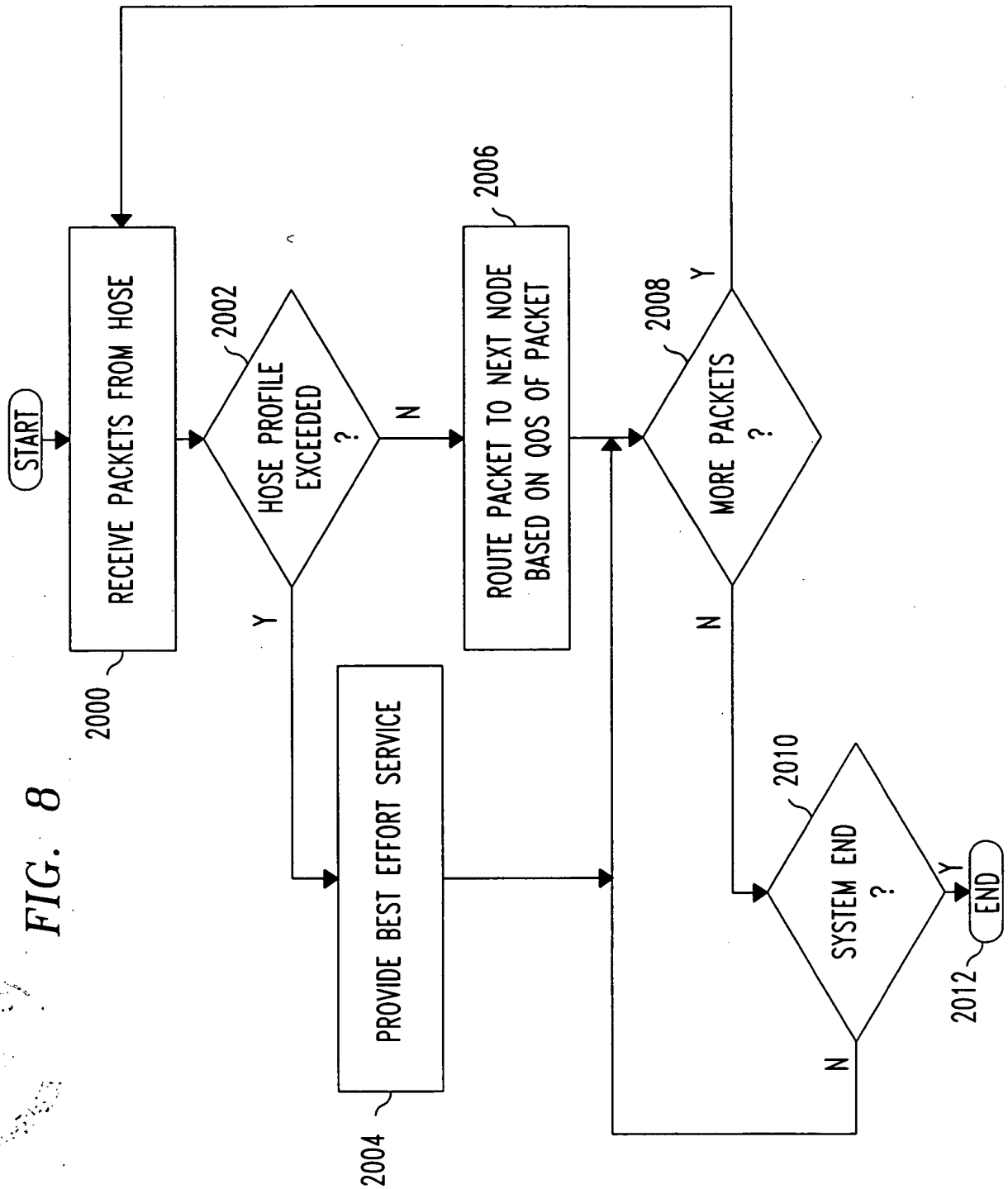
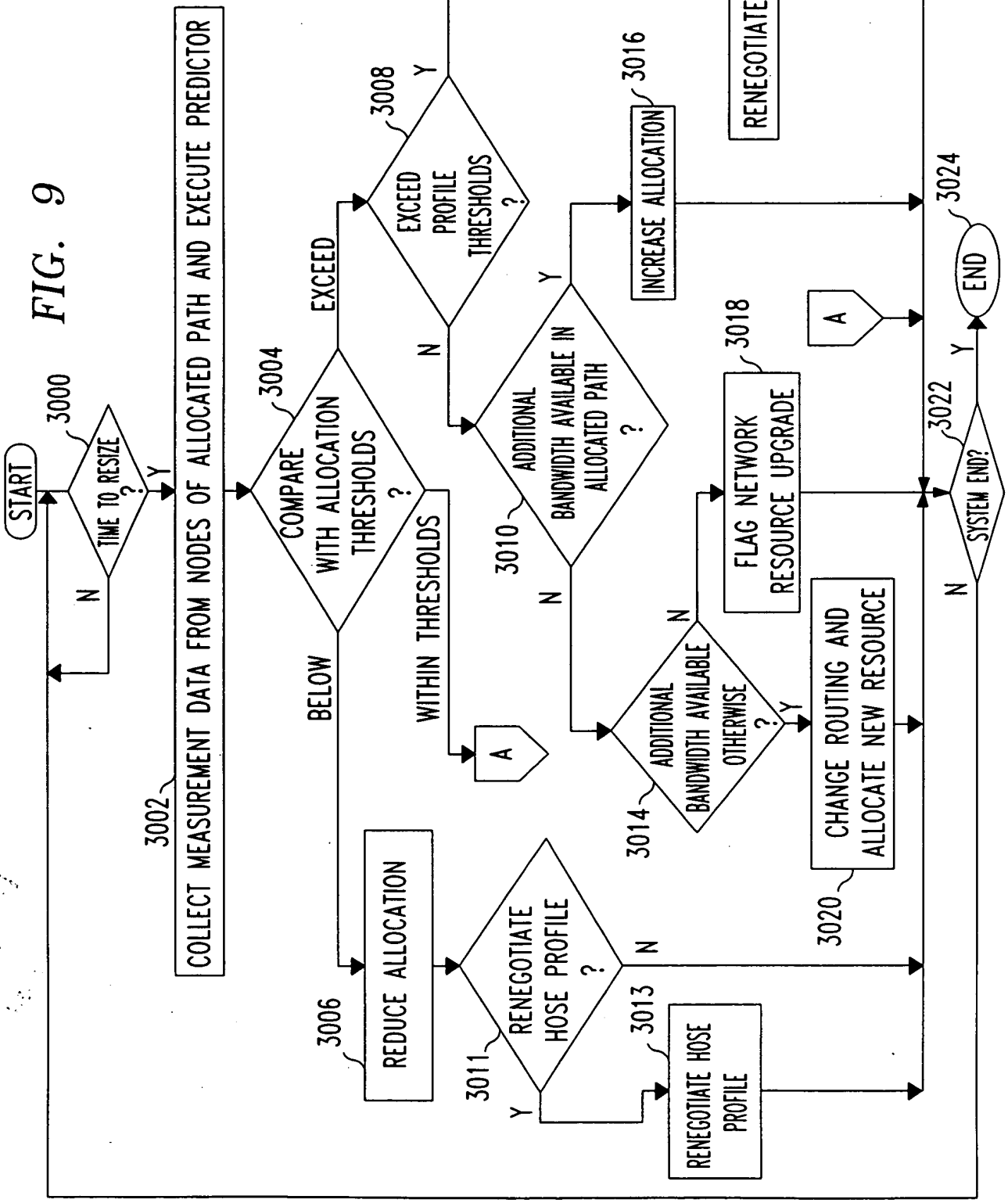

START
RECEIVE PACKETS FROM HOSE
2000
HOSE PROFILE EXCEEDED ?
2002
Y
N
PROVIDE BEST EFFORT SERVICE
2004
ROUTE PACKET TO NEXT NODE BASED ON QOS OF PACKET
2006
MORE PACKETS ?
2008
Y
N
SYSTEM END ?
2010
Y
N
END
2012

FIG. 8

FIG. 9


START
3000
TIME TO RESIZE ?
N
Y
3002
COLLECT MEASUREMENT DATA FROM NODES OF ALLOCATED PATH AND EXECUTE PREDICTOR
3004
COMPARE WITH ALLOCATION THRESHOLDS ?
BELOW
EXCEED
WITHIN THRESHOLDS
3006
REDUCE ALLOCATION
3008
EXCEED PROFILE THRESHOLDS ?
3010
ADDITIONAL BANDWIDTH AVAILABLE IN ALLOCATED PATH ?
3011
RENEGOTIATE HOSE PROFILE ?
3012
RENEGOTIATE HOSE PROFILE
3013
RENEGOTIATE HOSE PROFILE
3014
ADDITIONAL BANDWIDTH AVAILABLE OTHERWISE ?
3016
INCREASE ALLOCATION
3018
FLAG NETWORK RESOURCE UPGRADE
3020
CHANGE ROUTING AND ALLOCATE NEW RESOURCE
3022
SYSTEM END?
3024
END
A
A